

A New Cypraeid Subspecies and a New *Morum* from the Brazilian Molluscan Province

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ABSTRACT Two new endemic gastropods are named from the Brazilian Molluscan Province; a new cypraeid subspecies, *Erosaria acicularis marcuscoltroi* and a new moruminine harpid, *Morum berschaueri*. The new Brazilian cypraeid can be differentiated from the southeastern United States and Caribbean *Erosaria acicularis acicularis* in being a smaller, narrower, proportionally flatter, and more darkly-colored shell with a pale orange base and pale orange extremities. The new *Morum* is most similar to the widespread southeastern United States and Caribbean *Morum oniscus* but differs in being a much larger, thinner, and proportionally more inflated shell with larger and more prominent knobs on the body whorl, and in having a wider and more flaring aperture. The new cypraeid subspecies ranges from Para and Rio Grande do Norte states in the north to São Paulo State in the south, and is found in the Cearaian, Bahian, and northern Paulinian Subprovinces of the Brazilian Province. The new *Morum* is confined to the Bahian Subprovince and ranges from the Abrolhos Platform south to Guarapari, Espiritu Santo State.

INTRODUCTION

The Brazilian Molluscan Faunal Province, along with its three subprovinces, is still a relatively unknown biogeographical unit that has only been formally defined and described in the past two years (Petuch, 2013). Within the Tropical Western Atlantic Region, the Brazilian Province has been found to contain highly distinctive molluscan faunas with numerous endemic species, many of which are still undescribed and new to science. Over the past year (2014-2015), the authors have investigated the endemic cone shell faunas of the three Brazilian subprovinces, and this led to the descriptions of 13 new species (5 Conidae and 8 Conilithidae; see Petuch and Myers, 2014a and 2014b). The descriptions of these conoidean taxa, along with two other new Brazilian cones (Conidae) and a new Brazilian *Americoliva* species (Olividae) which were described a year earlier (Petuch, 2013), further enhanced the knowledge of the

biodiversity of the Brazilian Province molluscan fauna. Along with these newly-described species, the authors have also been able to acquire a number of other unnamed taxa in several important gastropod families, particularly the Cypraeidae and Harpidae. Because of their biogeographical importance, it was decided to describe two of these new taxa in this paper, including a previously-undescribed subspecies of the Atlantic Yellow Cowrie, *Erosaria acicularis* (Gmelin, 1791), and a distinctive new *Morum*, the largest of its genus in the western Atlantic. These important new endemic taxa are discussed in the following two sections.

1. The *Erosaria* Species Complex in the Tropical Western Atlantic

Until the discovery and recognition of the new Brazilian subspecies described here, the wide-ranging western Atlantic cowrie, *Erosaria*

acicularis (Gmelin, 1791) the “Atlantic Yellow Cowrie”, was thought to have an extremely large biogeographical range, extending from Cape Hatteras, North Carolina and Bermuda, southward along the southeastern United States and Florida Keys, throughout the Gulf of Mexico and Caribbean Sea Basin, and southward to Brazil (Abbott, 1974: 150; Petuch, 2013: 26-27; Tunnell *et al.*, 2010: 172; Warmke and Abbott, 1962: 92). Besides this wide-ranging western Atlantic species, a separate subspecies of *Erosaria acicularis* was also known from the islands of the central South Atlantic. This distinctive subspecies, *E. acicularis sanctaehelenae* (Schilder, 1930), is confined to St. Helena and Ascension Islands and differs from the nominal subspecies in having a more rhomboid shell shape, paler shell color, and a slightly more colored shell base (see Rosewater, 1975). Until recently, these two subspecies were thought to be the sole representatives of the genus *Erosaria* in the central and western Atlantic.

Several specimens of a small cypraeid labeled as “*E. acicularis*” were recently sent to the authors by the renowned Brazilian shell dealer and collector, Marcus Coltro. These specimens were also accompanied by large sets of data for 97 lengths, and collection localities, from the Brazilian coastline between Rio Grande do Norte and Rio de Janeiro states and from the offshore island complexes of Fernando de Noronha, Atol das Rocas, and Trindade. A close examination of these Brazilian specimens revealed several subtle, but consistent, differences between the Brazilian populations of *E. acicularis* and the populations from the southeastern United States, Gulf of Mexico, and Caribbean Region. These consistent differences, which are outlined under the following description, are prominent enough to demonstrate that the populations south of the Amazon River Mouth constitute a previously-

unrecognized subspecies of *E. acicularis*. The new subspecies, *E. acicularis marcuscoltroi*, which is named in this paper, represents the third-known *Erosaria* in the central and western Atlantic areas. This region, comprising the eastern coastlines of tropical and subtropical North and South America and the offshore islands, the Gulf of Mexico, the Caribbean Basin, the West Indian Arc, and the central oceanic islands of St. Helena and Ascension, is now known to house three separate subspecies of *E. acicularis*: the nominate subspecies *E. acicularis acicularis* (Gmelin, 1791) (from North Carolina and Bermuda south to Suriname); *E. acicularis marcuscoltroi* new subspecies (from eastern Para State to Sao Paulo State, Brazil); and *E. acicularis sanctaehelenae* (Schilder, 1930) (from St. Helena and Ascension Islands, central South Atlantic). The new Brazilian endemic subspecies is described here.

SYSTEMATICS

Class Gastropoda

Subclass Orthogastropoda

Superorder Caenogastropoda

Order Sorbeoconcha

Suborder Hypsogastropoda

Superfamily Cypraeoidea

Family Cypraeidae

Subfamily Erosariinae

Genus *Erosaria* Troschel, 1863

Erosaria acicularis marcuscoltroi new subspecies (Figure 3A-F)

Description. Shell of average size for genus, on average smaller than nominate subspecies; shell slightly rhomboid in outline, slightly flattened, with angled marginal calluses that protrude laterally out from shell midline; shell margin thickened, bordered with row of proportionally

large and deep pits and furrows that extend slightly onto the base of shell dorsum; base of shell white, often with faint infusions of pale orange along the columellar area and along columellar dentition; some specimens with large pale orange patch on columellar side of shell base; dentition white, often with pale orange staining between columellar teeth (as seen here on Figure 3B); margins white, marked with numerous small dark brown spots, which are especially prominent within the marginal pittings and furrows; dorsum most often colored dark orange or orange-tan, with numerous small, closely-packed paler orange-yellow spots and ocellations; dorsal spotting often amorphous and anastomosing, producing a blurred appearance; anterior and posterior extremities colored pale orange-tan or brighter yellow-orange (as on holotype); interior of aperture whitish-orange; labrum with 17-18 proportionally large, elongated teeth that extend onto shell base; columella with 14-15 large, thin teeth.



Figure 1. *Erosaria acicularis marcuscoltroi* n sp., paratype (See Figure 3A)

Type Material. HOLOTYPE: length 19 mm, width 13 mm, thickness (at mid-body) 9 mm, in the type collection of the Zoological Museum of the University of São Paulo, São Paulo, Brazil, number MZSP120184 (shown here on Figure 3D, E, F); PARATYPES: length, 18.2 mm, width 12 mm, thickness (at mid-body) 8 mm, from the type locality, in the research collection of the senior author (shown here on Figure 3A, B, C); length 15 mm, width 10 mm, thickness (at mid-body) 7 mm, from the type locality, LACM 3428 (in the type collection of the Department of Malacology, Los Angeles County Museum of Natural History); length 14 mm, width 9 mm, thickness (at mid-body) 6 mm, from the type locality, in the Berschauer collection, Laguna Hills, California; 3 specimens, length 15.9 mm, from Guarapari, Espírito Santo State, length 16.8 mm, Arraial do Cabo, Rio de Janeiro State, and length 18.5, Alcobaca, Bahia State, in the collection of Marcus Coltro, São Paulo, Brazil.

Type Locality. Collected under a large coral slab by a commercial lobster diver, in 15 m depth off Alcobaca, Abrolhos Platform, southern Bahia State, Brazil (May, 2014).

Range. Restricted to the coast of Brazil, from extreme northeastern Para State and Maranhão State, south to São Sebastião and Ilha Bela, São Paulo State (Simone and Goncalves, 2006), and on the Brazilian offshore archipelagoes of Fernando de Noronha, Atol das Rocas, Abrolhos, and Trindade and Martin Vaz.

Etymology. Named for Marcus Coltro of São Paulo, Brazil and Miami, Florida, well-known shell dealer and renowned shell collector and diver, in recognition of his many important malacological discoveries in Brazil and northern South America.

Discussion. The new Brazilian Province subspecies of the Caribbean Province and

Carolinian Province *Erosaria acicularis* differs from the nominate form in being consistently a smaller, more elongated, and less inflated shell, in having a darker and more intense dorsal color, in having pale orange or yellow-orange colored areas on the shell base and on the columella, and in having orange or yellow-orange extremities (as opposed to the pure white shell base, columella, and extremities of the nominate subspecies, shown here on Figure 3G, H, and J). The orange extremities readily differentiate the Brazilian subspecies from the northern nominate forms, which have distinctly white extremities. While *E. acicularis acicularis* is generally a bright yellow shell with a pure white base, *E. acicularis marcuscoltroi* is almost always a dark orange or orange-tan shell with a pale orange shell base. The orange shell base and the orange extremities are most intensely colored on freshly-collected specimens and fade slightly as the shell dries.

Besides differences in color, *E. acicularis marcuscoltroi* consistently is a more flattened, less globulose shell. This is readily demonstrated when a comparison of the shell morphometrics of the two subspecies is undertaken, utilizing an Index of Shell Inflation **I**, such that:

$$I = l/w (t)$$

where **l** = the **shell length**; **w** = the **shell width** (measured at the mid-body); and **t** = the **shell thickness** (measured at the shell mid-body). When the Index of Shell Inflation for specimens of *E. acicularis acicularis* and *E. acicularis marcuscoltroi* are listed in tabular form, the two subspecies can be seen to group into separate clusters. This clustering of **I** values is demonstrated by the morphometrics of the following eight specimens:

<i>Erosaria acicularis marcuscoltroi</i>	l	w	l/w	t	I
Holotype (MZSP, Brazil)	19 mm	13 mm	1.46	9 mm	13.14
Paratype (Petuch Collection)	18.2 mm	12 mm	1.52	8 mm	12.16
Paratype (LACM)	15 mm	10 mm	1.50	7 mm	10.5
Paratype (Berschauer Collection)	14 mm	9 mm	1.55	6 mm	9.3
Mean I = 11.28					
<i>Erosaria acicularis acicularis</i>	l	w	l/w	t	I
Missouri Key, Fla., (Figure 1G-I)	24.5 mm	18 mm	1.36	13 mm	17.68
Puerto Rico (Figure 1J, K)	25.1 mm	18 mm	1.39	14.8 mm	20.57
Eleuthera, Bahamas	25.5 mm	18 mm	1.41	15.1 mm	21.29
Grand Cayman	22 mm	20.1 mm	1.44	17.5 mm	25.20
(all 4 specimens in the Petuch Collection)	Mean I = 21.19				

Table 1. Morphological comparison of *E. acicularis acicularis* and *E. acicularis marcuscoltroi*

The dichotomy of the shell inflation indices between the Carolinian-Caribbean *Erosaria acicularis* (*sensu lato*) and the Brazilian populations, differing by a factor of two, supports the recognition of two separate and distinct subspecies.

This same biogeographic and evolutionary pattern, with a widespread Carolinian-Caribbean species and a Brazilian offshoot subspecies, is also seen in two other cypraeid genera; *Luria* and *Macrocypraea*. The widespread western Atlantic cowrie, *Luria cinerea* (Gmelin, 1791), ranges from North Carolina to Suriname and has a separate Brazilian subspecies, *Luria cinerea brasiliiana* Lorenz and Hubert, 1993. This southern offshoot differs in having finer apertural dentition than the nominate subspecies and in lacking the prominent dark brown staining between the columellar teeth. Similarly, the Carolinian-Caribbean *Macrocypraea zebra* (Linnaeus, 1758) also has a Brazilian offshoot, the southern subspecies *Macrocypraea zebra dissimilis* Schilder, 1924. This endemic Brazilian cypraeid generally lacks, or has a reduced number of, annular coloration spots along the shell margins and, in shape, closely resembles *Macrocypraea cervinetta* (Kiener, 1843) from the Panamic Molluscan Province (see Petuch, 2013 for a discussion of the biogeographic and evolutionary patterns of these four cypraeids). The wide ecological barrier of the Amazon River Mouth, with its extensive fresh water and brackish areas and organic-rich mud substrates, has genetically isolated the shallow neritic Carolinian and Caribbean *Erosaria acicularis*, *Luria cinerea*, and *Macrocypraea zebra* from their Brazilian counterparts, leading to the formation of three endemic subspecies; *E. acicularis marcuscoltroi*, *L. cinerea brasiliiana*, and *M. zebra dissimilis*.

2. The *Morum* Species Complex in the Tropical Western Atlantic

Within the tropical western Atlantic, the harpid subfamily Moruminae is represented by eight species in two separate genera (*Cancellomorum* Emerson and Old, 1963 and *Morum* Roding, 1798), making it the richest moruminine fauna found in a single region anywhere on Earth. Although thought to contain only seven species (Petuch, 2013), the biodiversity of the Moruminae was recently increased by the discovery of an eighth species in southern Brazil. Like the previously-described new cowrie subspecies, specimens of this new moruminine harpid were sent to the authors by Marcus Coltro, who collected the type lot near Guarapari, Espirito Santo State. Here named *Morum berschaueri*, this southern Brazilian harpid is the largest-known member of its genus and is endemic to the southern part of the Bahian Subprovince of the Brazilian Molluscan Province. The Subfamily Moruminae of the Tropical Western Atlantic Region is now known to contain the following genera and species (arranged here by biogeography):

Widespread Western Atlantic (Carolinian, Caribbean, and Brazilian Provinces)

Cancellomorum dennisoni (Reeve, 1842)
(North Carolina to Bahia, Brazil)

Caribbean Province and Southeastern Florida (Georgian Subprovince) only

Morum purpureum Roding, 1798 (= *Morum lamarcki* Deshayes, 1844)

Carolinian and Caribbean Provinces only

Morum oniscus (Linnaeus, 1767) (Georgian Subprovince to Surinamian Subprovince)

Venezuelan Subprovince (Caribbean Province) only

Cancellomorum lindae (Petuch, 1987)
(endemic to Colombia and Venezuela)

Southern and Western Caribbean Province and northern Brazilian Province

Morum strombiformis (Reeve, 1842)
(Nicaraguan Subprovince to Bahian Subprovince)

Brazilian Province only

Cancellomorum matthewsi (Emerson, 1967)
(Cearaian Subprovince only)
Morum bayeri Petuch, 2001 (Cearian and Bahian Subprovinces)
Morum berschaueri new species (Bahian Subprovince only)

Within the Tropical Western Atlantic Region, the molluscan fauna of the Carolinian Province is now known to contain three moruminine species (*C. dennisoni*, *M. oniscus*, and *M. purpureum*), while the molluscan fauna of the Caribbean Province is known to contain five species (*C. dennisoni*, *C. lindae*, *M. oniscus*, *M. purpureum*, and *M. strombiformis*). Although also containing five species, the moruminine fauna of the Brazilian Molluscan Province has the highest level of endemism, with three geographically-restricted species (*C. matthewsi*, *M. bayeri*, and *M. berschaueri*). These occur together with the widespread western Atlantic *C. dennisoni* and *M. strombiformis*. In this paper, we will be discussing and illustrating only the five members of the genus *Morum* and the new Brazilian species is described here:

SYSTEMATICS**Class Gastropoda****Subclass Orthogastropoda****Superorder Caenogastropoda****Order Sorbeoconcha****Suborder Hypsogastropoda****Infraorder Neogastropoda****Superfamily Muricoidea****Family Harpidae****Subfamily Moruminae****Genus *Morum* Roding, 1798**

***Morum berschaueri* new species**
(Figure 4A-F)

Description. Shell large for genus, thin, inflated, broadly conical; spire low, proportionally flattened, with only slightly stepped whorls; shoulder sharply angled, ornamented with 10 large flattened knobs; body whorl ornamented with 3 spiral rows of very large, rounded, evenly-spaced knobs, one at posterior end below shoulder, one around mid-body, and one around anterior end; posterior row of knobs align and combine with shoulder knobs to produce distinctive double row of knobs below shoulder angle; row of knobs around mid-body often bifurcating into 2 parallel rows of smaller knobs; anterior row of knobs proportionally large and always single in number, bordering the body whorl-siphonal canal juncture; 3 rows of body whorl knobs align with 10 low, evenly-spaced, rib-like longitudinal varices that correspond to shoulder knobs; numerous fine spiral cords are present between, and on top of, rows of large rounded knobs, with those on the siphonal canal and between rows of knobs being largest and coarsest; spire whorls ornamented with 3 large, coarse spiral cords; aperture proportionally wide and flaring; columellar area with wide adherent parietal shield, which is covered with numerous small, closely-packed pustules; outer lip thickened, with flattened edge; inner edge of lip ornamented with 18-24 large narrow teeth; shell color uniformly a pale cream-tan or yellow-tan, overlaid with scattered large amorphous patches of dark reddish-tan, particularly on the spire whorls; fine spiral cords on body whorl and spire whorls marked

with rows of small, evenly-spaced reddish-brown dots; edge of suture on spire whorls marked with row of evenly-spaced large, prominent reddish-brown dots and dashes; dorsal edge of lip marked with 4 large reddish-brown patches, one on spire area, two along the mid-body area, and one at the anterior end; parietal shield white, with some specimens having pale orange tones; outer lip and labial teeth white, with some specimens having infusion of pale orange; interior of aperture white; protoconch proportionally large, bulbous, mamillate, composed of 2 whorls, cream-white in color (shown here in Figure 4C, D).



Figure 2. *Morum berschaueri* n. sp., holotype (See Figure 4B)

Type Material. HOLOTYPE: length 31 mm, width 20.5 mm, in the type collection of the Zoological Museum of the University of São Paulo, São Paulo, Brazil, Brazil, number MZSP120186 (shown here on Figure 4A, B);

PARATYPES: length 35.2 mm, width 22 mm, from the type locality, in the research collection of the senior author (shown here on Figure 4C, D); length 35 mm, width 23.4 mm, from the type locality, in the Berschauer Collection, Laguna Hills, California (shown here on Figure 4E, F); length 32 mm, width 20 mm, from the type locality, in the research collection of the junior author.

Type Locality. Collected in algae, sponges and coral rubble, 15 m depth in the Guarapari Channel, Guarapari, Espírito Santo State, Brazil (2013).

Range. At present known only from the type locality, but may range northward to the Abrolhos Platform in southern Bahia State. The species appears to be endemic to the southern part of the Bahian Subprovince of the Brazilian Molluscan Province, particularly Espírito Santo State.

Etymology. The new taxon honors David Berschauer, Esq., of Laguna Hills, California, Co-Editor of *The Festivus* (San Diego Shell Club) and inspired amateur malacologist and naturalist.

Discussion. Of the five known western Atlantic *Morum* taxa, *M. berschaueri* is by far the largest-known species, being on average 10 mm longer than any other congener (averaging around 33 mm). Of the known Brazilian species, *M. berschaueri* is most similar to the widespread southern Caribbean-Brazilian *M. strombiformis* (Reeve, 1842) (Figure 5E, F), but differs in being a much larger, more inflated, and less cylindrical shell with proportionally larger and more prominent rows of rounded knobs on the body whorl. The new species is also similar to *Morum bayeri* Petuch, 2001 from the Cearaian and Bahian Subprovinces (Figure C, D), but differs in having a much larger, more

conical shell with a proportionally wider and more angled shoulder, in having proportionally larger and better-developed knobs on the shoulder and body whorl, and in lacking the black mottling and black color patches seen on *M. bayeri*. It is possible that all three species co-occur on the coral reefs along the outer edges of the Abrolhos Platform in southern Bahia State.

The other two *Morum* species found in the tropical Western Atlantic Region, *M. oniscus* (Linnaeus, 1767) (Figure 5A, B) and *M. purpureum* Roding, 1798 (Figure 5G, H), are morphologically more similar to *M. berschaueri* than are *M. bayeri* and *M. strombiformis*, especially in having three rows of prominent large, rounded knobs around their body whorls. Although having the same basic type of shell sculpture, the Carolinian-Caribbean *M. oniscus* and *M. purpureum* differ from *M. berschaueri* in being much smaller, proportionally more oval, and less-elongated shells. Although much smaller in size, the body whorl and shoulder knobs of *M. oniscus* and *M. purpureum* are proportionally much larger and better-developed than those seen on the specimens of the type lot of *M. berschaueri*. The new Brazilian species is also a less colorful and more poorly-marked species than *M. purpureum*, lacking the characteristic bright pink or purple parietal shield and dark brown color patches on the spire whorls.

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Figure 3. *Erosaria* Cowries from the Tropical Western Atlantic Region.

A, B, C= *Erosaria acicularis marcuscoltroi* Petuch and Myers, new subspecies. Paratype, length 18 mm. 15 m depth, off Alcobaça, southern Bahia State, Brazil. Petuch Collection. **D, E, F=** *E. acicularis marcuscoltroi* Petuch and Myers, new subspecies. Holotype, length 19 mm. 15 m depth, off Alcobaça, southern Bahia State, Brazil. MZSP120184. **G, H, I=** *E. acicularis acicularis* (Gmelin, 1791), length 24.5 mm. 3 m depth, off Missouri Key, Middle Florida Keys, Florida. **J, K=** *E. acicularis acicularis* (Gmelin, 1791), length 25.1 mm. 2 m depth off Boca de Cangrejos, San Juan, Puerto Rico.



Figure 4. *Morum berschaueri* Petuch and Myers, new species.

A, B= Holotype (MZSP120186), length 31 mm. 15 m depth in the Guarapari Channel, Guarapari, Espírito Santo State, Brazil. C, D= Paratype, length 35.2 mm. Guarapari Channel, Guarapari, Espírito Santo State, Brazil. Petuch Collection. E, F= Paratype, length 35 mm. Guarapari Channel, Guarapari, Espírito Santo State, Brazil. Berschauer Collection.